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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/811,370	03/25/2004	Chuan Hu	111079-134718	2079
25943	7590	09/01/2005	EXAMINER	
SCHWABE, WILLIAMSON & WYATT, P.C. PACWEST CENTER, SUITE 1900 1211 SW FIFTH AVENUE PORTLAND, OR 97204			HO, TU TU V	
			ART UNIT	PAPER NUMBER
			2818	

DATE MAILED: 09/01/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/811,370

Applicant(s)

HU ET AL.

Examiner

Tu-Tu Ho

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 13 July 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-30 is/are pending in the application.
- 4a) Of the above claim(s) 1-14 is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 15-30 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## DETAILED ACTION

### *Oath/Declaration*

1. The oath/declaration filed on 03/25/2004 is acceptable.

### *Election/Restriction*

2. Applicant's election without traverse of Invention II, claims 15-30, in the reply filed on 07/13/2005 is acknowledged.

3. Claims 1-14 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim. Election was made **without** traverse in the reply filed on 07/13/2005 as noted above.

### *Claim Rejections - 35 USC § 112*

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter that the applicant regards as his invention.

4. **Claim 23** is rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 33 recites: "wherein the die may have an effective coefficient of thermal expansion in the range of 15 ppm/C to 16 ppm/C. It is not clear what is covered and not covered by the limitation "may"; therefore, the limitation is indefinite.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. §103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

**5. Claims 15-16, 18-22, 24-28, and 30** are rejected under 35 U.S.C. §103(a) as being unpatentable over Vogel et al. U.S. Patent 6,317,326 (the '326 reference) in view of Lee et al. U.S. Patent Application Publication 20040036170 (the '170 reference).

Referring to **claims 15 and 24**, Vogel in the '326 reference discloses in Figs. 1 and 2A and respective portions of the specification a device substantially as claimed including a die (106 or 206) but fails to disclose that the die is a bumpless die as claimed.

Specifically, the reference discloses an apparatus, comprising:

a die (106 or 206) having a substantially planar surface (bottom surface) with a plurality of (not-shown-but-must-be-present-for-the-device-to-function) embedded bonding pads;

a heat spreader lid (110 or 210) having the die mounted thereto;

a die carrier (102 or 202) having a plurality of solder bumps (108 or 208) attached thereto; and

the solder bumps being bonded to the bonding pads.

However, the reference fails to disclose that (1) the die is a bumpless die and (2) also fails to disclose product-by-process limitations such as "to form a module", "the module being mounted to the die carrier", and "when the module is mounted to the die carrier".

Nevertheless, as for (2), product-by-process limitations are considered non-limitations in a product claim, therefore such limitations are non-material in determine patentability (MPEP 2112.01 and MPEP 2113).

As for (1), the 170 reference, in also disclosing an apparatus having a die with embedded bonding pads (bumpless die 140, Fig. 4, for example), teaches that the die should be a bumpless die to reduce cost and reliability issue (paragraph [0011], specifically "...first set of conductive bumps may be configured to correspond with bond pad locations on at least one bumpless semiconductor die.... With this arrangement, the present invention provides structure for effecting interconnections on the interposer substrate for both a first level interconnection and second level interconnection, thereby eliminating the need for wafer bumping and the costs and reliability issues associated therewith").

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the '326 reference's device such that the die (106 or 206) is a bumpless die. One would have been motivated to make such a change in view of the teachings in the '170 reference that such a change results in lower cost and higher reliability.

Referring to **claims 24-27**, the '326 reference further fails to teach that the apparatus, also known as an integrated circuit (IC) package in the art and as recited in claim 24, could be mounted to a circuit board, that the IC package could be coupled to a dynamic random access memory and an input/output interface. However, since the reference also fails to exclude such usage, such utilization of the IC package would have been obvious to one of ordinary skill in the art at the time the invention was made.

Referring to **claims 18 and 30**, the '326 reference further discloses a thermal interface material (114 or 214) interposed between the die and the heat spreader lid to bond the die to the heat spreader lid, and that the material could be a solder (column 3, lines 48-53).

Referring to **claims 20 and 21**, the '326 reference further discloses that the plurality of solder bumps (108, Fig. 1) forms a gap between the die and the die carrier, with the gap containing only the plurality of solder balls and empty space and that the plurality of solder bumps (208, Fig. 2A) forms a gap between the die and the die carrier, with the gap containing only the plurality of solder balls and an underfill (209).

Referring to **claims 16, 19, 22, and 28**, although the '326 reference fails to teach the various claimed sizes, the various claimed sizes are within the level of ordinary skill in the art to experiment with therefore would have been obvious.

6. **Claims 17 and 29** are rejected under 35 U.S.C. §103(a) as being unpatentable over Vogel et al. U.S. Patent 6,317,326 (the '326 reference) in view of Lee et al. U.S. Patent Application Publication 20040036170 (the '170 reference) as applied above for claims 16 and 28, and further in view of Sheu et al. U.S. Patent 6,455,943.

The '326 reference in view of the '170 reference teaches an apparatus including an IC device as claimed and as detailed above including the inherent bonding pads. However, the teachings fail to disclose that the bonding pads are dual-damascene-formed copper bonding pads.

Sheu, in also disclosing an IC device, teaches that a dual-damascene process allows the upper bonding pad and the underlying plug part of the bonding pad to be formed at the same time (paragraph bridging columns 2 and 3, particularly: "the bonding pad structure can be formed by

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using a dual damascene process, that is, the conductive islands and the conductive plugs are formed together"). In column 5, line 58+, Sheu further teaches that dual-damascene-formed bonding pad is formed of copper.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the '326/170 reference's device such that the inherent bonding pads are dual-damascene-formed copper bonding pads. One would have been motivated to make such a change in view of the teachings in Sheu that a dual-damascene process allows the upper bonding pad and the underlying plug part of the bonding pad to be formed at the same time.

7. **Claims 15-16, 18-19, 21-22, 24-28, and 30** are rejected under 35 U.S.C. §103(a) as being unpatentable over Lee U.S. Patent Application Publication 20040159957 (the '957 reference) in view of Gektin et al. U.S. Patent Application Publication 20040042178.

Referring to **claims 15 and 24**, Lee in the '957 reference discloses in Figs. 9A-9B and 12 and respective portions of the specification a device substantially as claimed including a heat spreader (180, Fig. 12, paragraph [0085]) but fails to disclose that the heat spreader is a lid as claimed.

Specifically, the reference discloses an apparatus, comprising:

- a bumpless die (150, Fig. 9A) having a substantially planar surface (bottom surface) with a plurality of embedded bonding pads (158, paragraph [0070]);
- a heat spreader (180) having the die mounted thereto;
- a die carrier (110) having a plurality of solder bumps (156) attached thereto; and
- the solder bumps being bonded to the bonding pads.

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However, the reference fails to disclose that (1) the heat spreader is a heat spreader lid and (2) also fails to disclose product-by-process limitations such as “to form a module”, “the module being mounted to the die carrier”, and “when the module is mounted to the die carrier”.

Nevertheless, as for (2), product-by-process limitations are considered non-limitations in a product claim, therefore such limitations are non-material in determine patentability (MPEP 2112.01 and MPEP 2113).

As for (1), Gektin, in also disclosing an apparatus having a die and a heat spreader, teaches that the heat spreader may also function as a lid to physically protect the die (paragraph [0005]: “thermally conductive element may also function as a lid to physically protect the electronic component.”).

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the ‘957 reference’s device such that the heat spreader is a heat spreader lid. One would have been motivated to make such a change in view of the teachings in Gektin that such a change results in a heat spreader that also functions as a lid to physically protect the die.

Referring to **claims 24-27**, the ‘957 reference further disclose that the apparatus, also known as an integrated circuit (IC) package in the art and as recited in claim 24, could be mounted to a circuit board (570, Fig. 28), that the IC package could be coupled to a memory (storage) and an input/output interface (574,576). However, the reference fails to teach that the memory is a random access memory and further fails to teach a networking interface and that the IC could be used in an entertainment unit. Nevertheless, since the reference also fails to exclude



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such usage, such utilization of the IC package would have been obvious to one of ordinary skill in the art at the time the invention was made.

Referring to **claims 18 and 30**, although the '326 reference fails to disclose a thermal interface hard solder material interposed between the die and the heat spreader lid to bond the die to the heat spreader lid, the use of a thermal interface hard solder material interposed between the die and the heat spreader lid to bond the die to the heat spreader lid at the time the invention was made was known to artisans in the art, as disclosed previously, therefore such modification would have been obvious.

Referring to **claim 21**, the '326 reference further discloses that the plurality of solder bumps (158) forms a gap between the die and the die carrier, with the gap containing only the plurality of solder balls and an underfill (116).

Referring to **claims 16, 19, 22, and 28**, although the '326 reference fails to teach the various claimed sizes, the various claimed sizes are within the level of ordinary skill in the art to experiment with therefore would have been obvious.

8. **Claims 17 and 29** are rejected under 35 U.S.C. §103(a) as being unpatentable over Lee U.S. Patent Application Publication 20040159957 (the '957 reference) in view of Gektin et al. U.S. Patent Application Publication 20040042178 as applied above for claims 16 and 28, and further in view of Sheu et al. U.S. Patent 6,455,943.

The '957 reference in view of Gektin teaches an apparatus including an IC device as claimed and as detailed above including the bonding pads 158. However, the teachings fail to disclose that the bonding pads are dual-damascene-formed copper bonding pads.

Sheu, in also disclosing an IC device, teaches that a dual-damascene process allows the upper bonding pad and the underlying plug part of the bonding pad to be formed at the same time (paragraph bridging columns 2 and 3, particularly: “the bonding pad structure can be formed by using a dual damascene process, that is, the conductive islands and the conductive plugs are formed together”). In column 5, line 58+, Sheu further teaches that dual-damascene-formed bonding pad is formed of copper.

Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to form the device of the '957 reference in view of Gektin such that the bonding pads are dual-damascene-formed copper bonding pads. One would have been motivated to make such a change in view of the teachings in Sheu that a dual-damascene process allows the upper bonding pad and the underlying plug part of the bonding pad to be formed at the same time.

### *Conclusion*

9. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tu-Tu Ho whose telephone number is (571) 272-1778. The examiner can normally be reached on 6:30 am - 5:00 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, DAVID NELMS can be reached on (571) 272-1787. The fax phone number for the organization where this application or proceeding is assigned is (703) 872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications

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may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Tu-Tu.Ho  
August 25, 2005